

## FIBERS IN THE SECONDARY XYLEM OF AESCHYNOMENE

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WHILE WORKING on the petrified woods from the Deccan Intertrappean beds of India, I encountered a fossil wood which proved to belong to the genus *Aeschynomene*, of the family Leguminosae. In the course of this identification, doubts arose as to the proper interpretation of the ground-mass of the secondary xylem in *Aeschynomene*. Solereder (1908, pp. 275–276, *fig. 117a*; Taubert, 1894, p. 319) and Metcalfe and Chalk (1950, p. 523, *figs. 117a–d*) report that the parenchyma constitutes the greater part of the tissues in this genus and forms a ground-mass in which groups of fibers and vessels are distributed. Indeed, the elements of the ground-mass very much resemble those of fusiform parenchyma cells. However, my own investigation shows a different interpretation.

Thin sections of the woods of *Aeschynomene hispida* Willd. (Yw \* 2169), *A. cf. aspera* L. (Yw 37202), *A. sensitiva* Sw. (Yw 43509), and an unidentified species (Yw 16552) were examined. These preparations were made from dried material in which, unfortunately the protoplasmic contents and the starch grains were no longer visible. Professor I. W. Bailey suggested that the ground-mass appeared to be composed of fibers. He further suggested that this could be confirmed from fresh material of *Aeschynomene* and by examining it without hydrofluoric acid treatment. Through the courtesy of Dr. P. T. Richards, of the Imperial College of Tropical Agriculture, Trinidad, West Indies, I secured fresh material of *Aeschynomene sensitiva* Sw. collected in Trinidad and preserved in formalin-acetic-alcohol. The present study is based on this material which was sectioned at 20–25 micra and stained in Haidenhain's iron-alum haematoxylin and safranin. A part of the wood was also macerated in chromic-nitric acid.

As the objective of this study was to ascertain the nature of the ground-mass of *Aeschynomene*, i.e., whether it is parenchymatous or fibrous, the observations given here are confined to the secondary wood. The microscopic examination of the cells forming the ground-mass shows that they are devoid of protoplasmic contents and do not possess starch grains (Figs. 2, 5). This indicates their nonliving condition in the mature wood and, hence, their fibrous nature. It is interesting to note that this tissue shows a variety of cell structures, from libriform fibers to intermediate forms which are difficult to classify (Fig. 1b–f), culminating in a type of cell similar in shape to the fusiform cambial initials. In addition to these prosenchymatous cells, but excluding cells of ray parenchyma, there are other types in the secondary xylem which possess protoplasmic contents with nuclei, as well as starch grains (Fig. 6). These are the true

\* Record Memorial Wood Collection, Yale University; citation of wood specimens as proposed by Stern and Chambers, *Taxon* 9: 1. 1960.

parenchymatous cells forming the longitudinal parenchyma of the wood. Their parenchymatous nature is also shown in some cases by the presence of septa, forming strands of two to four cells (FIG. 5). In the present species the longitudinal parenchyma is usually associated with the vessels in a scanty, abaxial and aliform to confluent distribution (FIGS. 2, 4).

A study of different forms of fiber and longitudinal parenchyma cells shows that the fusiform cambial initials differentiate two types of cells: (1) fusiform parenchyma cells, which may divide into parenchyma strands of two to four cells (FIGS. 5, 1b<sup>1</sup>, b<sup>2</sup>), and (2) libriform fibers, with long, attenuated ends, which are associated with a series of cell types of various shapes, including those possessing a form like that of fusiform cambial initials (FIG. 1b-f).

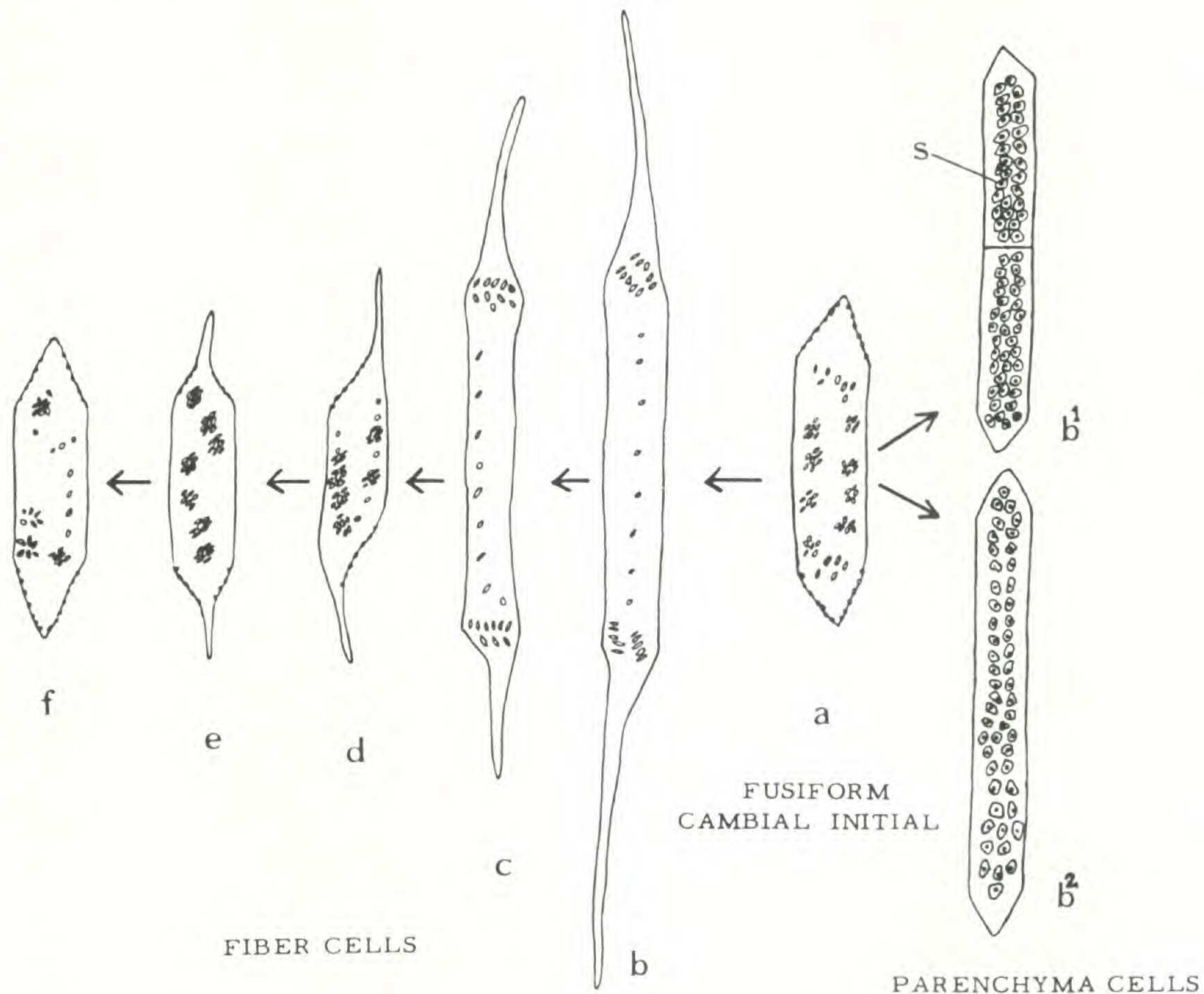


FIG. 1. Semidiagrammatic camera lucida sketch showing various types of fiber and parenchyma cells in *Aeschynomene sensitiva*,  $\times 235$ . Parenchyma cells contain starch grains (s). See explanation in text.

From the above considerations it is quite evident that the fibers constitute the greater part of the tissues in the secondary wood of *Aeschynomene* and form a ground-mass in which the parenchyma and vessels are distributed. In view of these interpretations, the wood of *Aeschynomene sensitiva* Sw. is described below.

*Growth rings*: Not seen. *Vessels*: Small, 20–65  $\mu$  in tangential diameter

(mean 42  $\mu$ ), chiefly solitary, occasionally in multiples of 2–4 cells or rarely in clusters (FIG. 2), quite uniform in size and evenly distributed, thin walled; solitary vessels mostly polygonal to oval in cross section. Vessel elements 90–210  $\mu$  long, with truncate to oblique end walls. Perforation plates exclusively simple, horizontal to slightly oblique. Intervascular pit-pairs vestured, alternate to opposite or subopposite, orbicular to oval in cross section, 7–10  $\mu$  in diameter, with linear to lenticular apertures, sometimes coalescent (FIG. 7). Tyloses absent.

*Parenchyma*: Paratracheal, scanty abaxial or vasicentric, sometimes forming irregular wings which rarely unite to form confluent parenchyma (FIGS. 2, 4); rarely isolated diffuse parenchyma cells also seen among the fibers. Parenchyma cells storied, thin walled, angular in cross section, 10–18  $\mu$  in diameter and containing nucleus, starch grains, cytoplasm, and protoplasmic contents (FIGS. 4–6). Parenchyma cells fusiform or in 2–4-celled strands (FIG. 5), sometimes chambered with solitary crystals in each chamber.

*Xylem rays*: Homogeneous (Kribs Homogeneous Type 3) composed of procumbent cells, storied, mostly uniseriate, sometimes biseriate (FIG. 5), rarely quite broad and containing vascular strands; uniseriate rays 1–24 (often 8–10) cells high; up to 10–15 rays per mm. Ray cells variously shaped, square, rectangular, oval to oblong and rarely pointed at one end, containing starch grains (FIG. 5).

*Imperforate tracheary elements*: Mostly thin walled, sometimes slightly thicker walled, especially near the vessels, and extending tangentially from them (FIG. 3), usually polygonal (mostly 5 or 6 sided) in cross section with large lumina, about 10–25  $\mu$  in diameter (FIGS. 2, 3, 4); non-septate; storied (FIG. 5); pits simple, slightly more numerous on the radial than on the tangential walls, often appearing to be arranged in groups (FIG. 1b–f); pitting often markedly more abundant on and near the pyramidal walls. Cells variously shaped in longitudinal section (FIG. 1b–f), varying from libriform fibers to a fusiform type.

The author wishes to express his sincere appreciation to Professor Elso S. Barghoorn for his kind advice and for his critical reading of the manuscript. To Professor I. W. Bailey are extended many thanks for his help in cutting microtome sections of the wood of *Aeschynomene sensitiva* and for his many valuable suggestions. Dr. P. T. Richards, of the Imperial College of Tropical Agriculture, Trinidad, and Dr. William L. Stern (then curator of the S. J. Record Memorial Collection, Yale University), curator, Division of Woods, National Museum, Smithsonian Institution, Washington, D. C., have kindly made available woods of extant species of *Aeschynomene*, for which the author is greatly indebted. This study was completed while the author was a participant in the Visiting Research Scientists Program of the National Academy of Sciences, Washington, D. C., to which he is grateful for financial assistance.

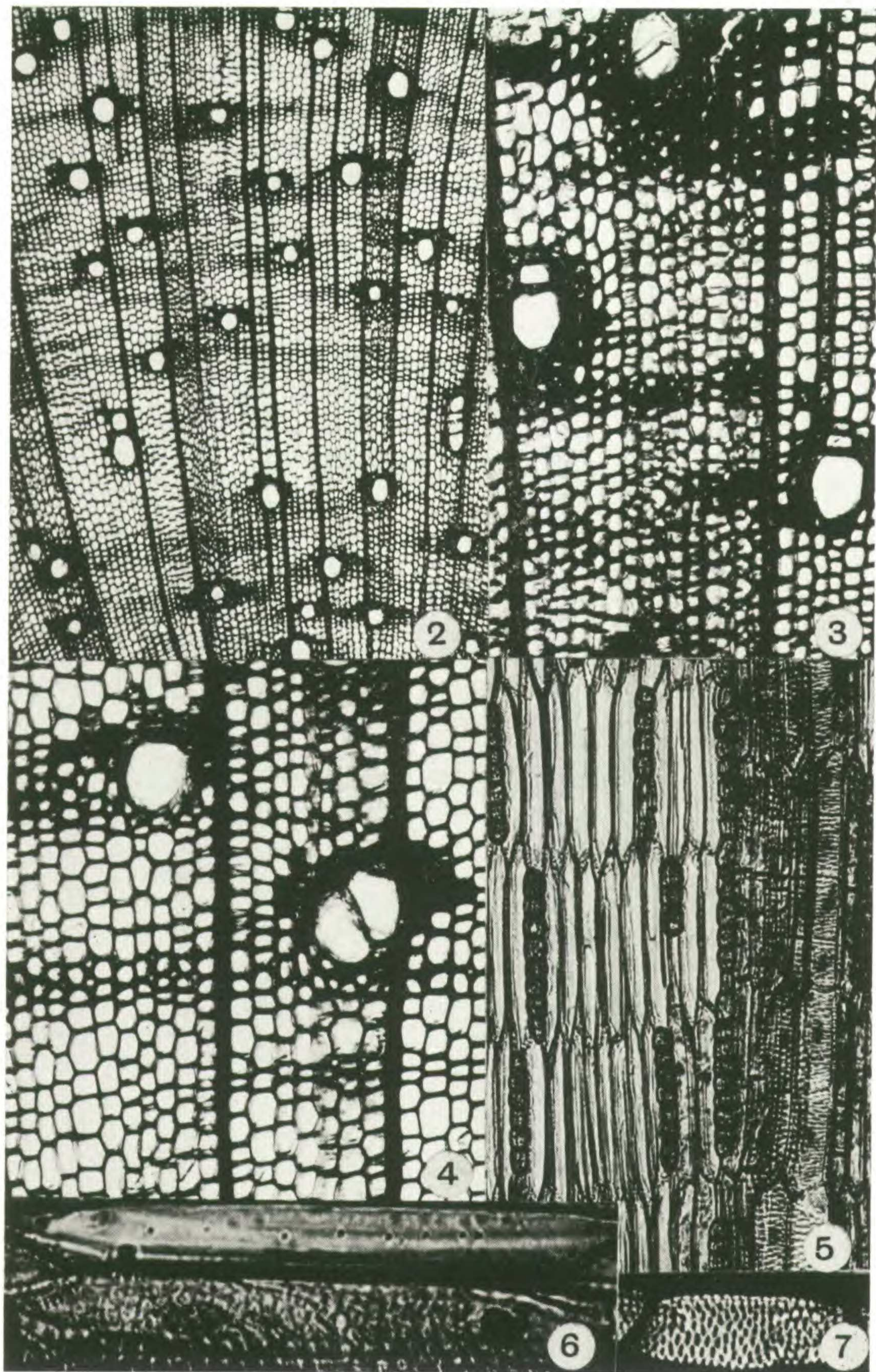
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## EXPLANATION OF PLATE

FIGS. 2-7. Modern wood of *Aeschynomene sensitiva*. 2, Transverse section,  $\times 50$  — note vessel and parenchyma distribution; parenchyma cells appear black due to presence of starch grains in them. 3, Transverse section magnified to show the distribution of thick-walled fibers  $\times 140$ . 4, Transverse section magnified,  $\times 140$  — note paratracheal parenchyma with starch grains (shaded black). 5, Tangential section,  $\times 140$  — note storied rays, fibers, and parenchyma. 6, Longitudinal section of a parenchyma and a fiber cell,  $\times 455$  — note starch grains and nucleus in the parenchyma cell. 7, Intervascular pitting,  $\times 180$ .



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